DOE Site:	Portsmouth, OH
EM Project:	On-Site Disposal Facility
ETR Report Date:	February 2008

ETR-12

External Technical Review Summary

United States Department of Energy Office of Environmental Management (DOE-EM)

External Technical Review of the Proposed On-Site Waste Disposal Facility (OSWDF) at the Portsmouth Gaseous Diffusion Plant

Why DOE-EM Did This Review

The On-Site Waste Disposal Facility (OSWDF) is proposed for long-term containment of contaminated materials from the planned Decontamination and Decommissioning (D&D) activities at the Portsmouth Gaseous Diffusion Plant. Acceptable performance of the proposed OSWDF will depend on interactions between engineered landfill features and operations methods that recognize the unique characteristics of the waste stream and site-specific environmental conditions. The design and environ-mental controls were selected to provide a greater level certainty that long-term disposal capacity would be available to support D&D and Remediation activities. *The objective of the review was to evaluate the public acceptance and regulatory processes and to provide initial input on facility design.*

What the ETR Team Recommended

1. Recognizing that public involvement is critical to acceptance, DOE will need to involve stakeholders at the beginning and create a partnership in determining siting and environmental control designs. An independently chartered organization could be created to facilitate interaction between all interested parties and DOE.
2. Documentation should be electronic and paper, presented at multiple technical levels to fully address the educational and functional interests of the stakeholders.
3. Fully communicate the strong operating record of the on-site disposal facilities in the DOE Complex and the positive impact stakeholders have had at other sites (e.g. Hanford).
4. Consider establishing a perpetual maintenance and monitoring fund at the onset to assure stakeholders of the integrity of the OSWDF over the long term.
5. The following design considerations were recommended: (a) Site selection should avoid locations with existing ground water contamination and/or buildings, (b) Sumps should be located to one side versus centrally, (c) Provide dedicated haul roads for transporting waste, and (d) use automated methods where practical.

What the ETR Team Found

The Independent technical team found that DOE was working in all of the recommended areas of public involvement and acceptance and appeared to have incorporated lessons learned from prior disposal facility design and permitting experiences. The recommendations were provided to enhance the current efforts. The team considered the implications of CERCLA versus RCRA, but deferred the analysis to DOE to weigh the advantages and disadvantages of both approaches. Generally CERCLA addresses inactive hazardous waste sites involving past disposal issues and RCRA addresses “cradle-to-grave” management of hazardous waste.

In the area of design, logistics of construction and D&D should be considered to avoid using the landfill for clean versus contaminated materials. Operations should minimize Void space by compacting and crushing waste.

To view the full ETR reports, please visit this web site:
http://www.em.doe.gov/Pages/ExternalTechReviews.aspx

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The purpose of an External Technical Review (ETR) is to reduce technical risk and uncertainty. ETRs provide pertinent information for DOE-EM to assess technical risk associated with projects and develop strategies for reducing the technical risk and to provide technical information needed to support critical project decisions. Technical risk reduction increases the probability of successful implementation of technical scope. In general, ETRs assesses technical bases, technology development, and technical risk identification and handling strategies.

Independent Technical Review Report: Portsmouth Gaseous Diffusion Plant

Review of Issues Associated with the Proposed On-Site Waste Disposal Facility (OSWDF) at Portsmouth

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Sponsored by:

The Office of Engineering and Technology (EM-20)

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1. INTRODUCTION

The US Department of Energy (DOE) has proposed that some wastes generated from decontamination and decommissioning (D&D) activities at the Portsmouth (PORTS) Gaseous Diffusion Plant (GDP) be disposed in an on-site landfill referred to as the On-Site Waste Disposal Facility (OSWDF). A conceptual design for the OSWDF is described in DOE (2006).

The OSWDF was selected from a number of alternatives as being optimal in terms of environmental performance, public safety, and cost. The following benefits of the OSWDF relative to other disposal strategies have been proffered:

- acceleration and cost reduction of the PORTS D&D and remediation activities;
- reduced risks and potential injuries from transport of wastes to an off-site facility;
- provision of a greater level of certainty that long-term disposal capacity would be available at PORTS to support D&D and remediation activities; and
- provision of jobs and service needs within the local economy.

A schematic of the OSWDF and associated facilities is shown in plan view in Fig. 1. The OSWDF would be comprised of 10 cells. Each cell would be lined with a state-of-the-art double liner system consisting of two composite liners (Fig. 2). The lower composite liner would consist of a 1.5-mm-thick textured HDPE geomembrane over a clay layer at least 915 mm thick and having a saturated hydraulic conductivity no greater than 10^{-7} cm/s. The upper composite liner would be comprised of a 1.5-mm-thick textured HDPE geomembrane underlain by a geosynthetic clay liner (GCL).

Leachate on the upper liner would be managed using a leachate collection system. Liquid migrating through the primary liner would be removed by a secondary leachate collection system, which is often referred to as a 'leak detection system' in practice. Granular materials (305 mm thick) would be used on the base grades for both the leachate collection system and the leak detection system (Fig. 2a). A geotextile cushion would be installed between the geomembrane and the granular materials to protect the geomembrane. On the slopes, a geocomposite drainage layer (geonet sandwiched between two non-woven geotextiles) would be used instead of granular materials (Fig. 2b). Liquids in both layers would be routed to sumps and removed periodically with pumps deployed through side slope risers (Fig. 3).

An engineered final cover would be installed over the waste when the OSWDF is closed. A multi-layer cover design (Fig. 4) would be employed that relies on a composite barrier overlain by a drainage layer, a biointrusion layer, and a vegetated surface layer. The design is analogous to the final cover used for the On-Site Disposal Facility (OSDF) at Fernald and the

Environmental Management Waste Management Facility (EMWMF) at Oak Ridge. The composite barrier would consist of 610 mm of clay overlain by a GCL and a textured 1.0-mm-thick LLDPE geomembrane. The drainage layer (305 mm thick) would be constructed from granular materials. A cushion geotextile would be placed between the drainage layer and the geomembrane for puncture protection. Dumped rock fill (915 mm) would be used for the biointrusion layer. A thin layer of choke stone overlain by 150-mm of sand would be used to provide separation between the biointrusion layer and the surface layer. The vegetated surface layer would be 685 mm thick, including 150 mm of top soil at the surface.

2. OBJECTIVE AND SCOPE

DOE requested that an Independent Technical Review (ITR) team provide input on several lines of inquiry related to the proposed OSWDF. The ITR team, which was comprised of Craig H. Benson, PhD, PE (University of Wisconsin; Madison, WI), William H. Albright, PhD (Desert Research Institute; Reno, NV), David P. Ray, PE (US Army Corps of Engineers; Omaha, NE), and John Smegal (Legin Group; Washington, DC), has expertise in waste containment, civil engineering, geotechnical engineering, and project management. The ITR team was requested to address the following lines of inquiry (LOI):

1. What should the project do to facilitate public involvement in the decision-making process?

2. What materials should the project develop to help inform the public?

3. What are the lessons learned from other DOE on-site disposal facilities that would apply to the public and regulator decision making process?

4. What are the lessons learned from proposed on-site disposal facilities that were not approved by the public and the regulators?

5. What are the resources that would be useful to inform the public on the concept of an on-site disposal facility?

6. The Department has proposed to develop an on-site disposal facility under CERCLA. Some of the regulators from the State of Ohio have recommended a RCRA permit approach. What are the lessons learned that would apply to the evaluation of these two concepts for the Portsmouth D&D Project?

These LOI were addressed by conducting a site visit on 9 January 2008, reviewing preliminary design documents provided by DOE personnel from PORTS, and based on the experience of the ITR team. Findings of the ITR team for each of the LOI are described in the following sections.

In addition, the ITR team has provided specific technical comments on the preliminary design of the OSWDF. The ITR team recognizes that the final proposed design may differ from the design presented in the conceptual design document; nonetheless, the ITR team offers these comments as an aid in the deliberations for a final proposed design. These comments are included in the appendix.

3. LINE OF INQUIRY NO. 1

What should the project do to facilitate public involvement in the decision-making process?

Public involvement will be critical to acceptance of the proposed OSWDF. DOE could follow a variety of approaches to set up or assist in the formation of public groups. The approach that is followed should ensure that the groups are autonomous, free to speak, and unfettered by DOE. In addition, some groups will form on their own, probably in opposition to the OSWDF. Ensuring that each group is given ample opportunity to ask questions and be heard on their issues will be important. This will be a challenge, and DOE will need to use extreme care to ensure that some groups are not perceived as receiving favorable or greater attention by DOE relative to other groups.

If a CERCLA approach is followed to develop the OSWDF, the CERCLA process will provide some structure to public involvement. This structure would include scheduling and conducting interviews with local officials and community residents to solicit concerns and information, developing a formal community relations and public involvement plan based on these interviews, establishing an administrative record and at least one information repository, and notifying the community of the information repository in a local newspaper and in a fact sheet.

Coordinating stakeholder discussion and responses will be a challenge. One idea is for DOE to set up an independent umbrella group that would facilitate interactions between all interested parties and DOE. This group would be funded by DOE under a defined set of guidelines, but would be independently chartered and would not answer to DOE. Lessons learned from other DOE remedial activities may be helpful in indentifying the most effective structure for coordinating and responding to stakeholder issues. DOE personnel at PORTS indicate that this type of organization is under consideration.

DOE should also provide mechanisms that allow stakeholders not affiliated with a group to voice their concerns and receive responses from DOE. This could be achieved through a combination of a public information website and a staffed telephone number. Providing responses in timely and thoughtful manner will be important.

4. LINE OF INQUIRY NO. 2

What materials should the project develop to help inform the public?

Documentation should be provided that has information at several levels in both electronic (web site) and paper format. Paper documents should be deposited at a public institution that is readily available to stakeholders in the community (e.g., local public library).

An inclusive summary should be the starting point. This should be prepared in layman's terms and should avoid technical jargon. Many stakeholders may only read this section, and achieving their confidence at this level will be particularly beneficial. The summary should identify the purpose and need for the project, and describe the analysis of alternatives that was conducted. This description should describe the benefits, costs, and risks associated with the OSWDF (and the alternatives) in a frank, clear, concise, and consistent manner. The document should also point out the long-term employment opportunities for the community and virtual assurance of inflow of federal capital for completion of the project. This document should be prepared for a reader with middle-school capabilities.

A second level of supporting documentation would have a moderate level of technical discussion coupled with a collection of references to other documents with more detailed information. This section would focus on addressing technical concerns of more technologically experienced stakeholders, without overwhelming them with technical information. The presentation style will be important. This portion of the document should be easy to read and prepared for a reader that has a high school education. The document should be upfront about the predicted effects of the OSWDF and uncertainty inherent in the predictions.

A third level of supporting documentation would provide technical details substantiating the assumptions and design details of the OSWDF. This section would be oriented towards the well-educated and experienced stakeholder who will fully explore the nuances of DOE's proposed approach. Technical consultants hired by stakeholder groups might also use these materials to investigate the efficacy of the OSWDF. This section would need to be prepared with a high level of technical competence and clarity.

At all levels, the documentation should include supporting information from the institutional history being complied at other on-site disposal facilities being operated in the DOE complex. Both positive and negative information should be provided to avoid the perception of presenting an overly optimistic perspective. Methods used to resolve negative occurrences should also be included to demonstrate that mistakes are dealt with in timely and technically sound manner.

This document should also include and rely on performance information from other hazardous and non-hazardous waste disposal facilities employing similar containment technologies. For example, US EPA published a landfill performance study[1] (Bonaparte et al. 2002) demonstrating that modern composite barrier technologies are extremely effective at protecting ground water.

[1] http://www.epa.gov/ord/NRMRL/pubs/600r02099/600R02099.pdf

5. LINE OF INQUIRY NO. 3

What are the lessons learned from other DOE on-site disposal facilities that would apply to the public and regulator decision making process?

The strong operating record of on-site disposal facilities in the DOE complex should be presented as part of the decision-making process. Modern facilities constructed and operated by DOE sites have been demonstrated as a safe and reliable means of disposing hazardous waste, low-level radioactive waste, and mixed low-level radioactive waste.

The public is always concerned about the legacy associated with landfills, and the potential for the owner to neglect operation, maintenance, and remedial actions that may be needed in the future. This is a less significant problem for sites in the DOE complex, as the US government is the owner and is unable to shirk responsibility for its sites using legal/financial mechanisms (e.g., bankruptcy) as might occur in the private sector. Nevertheless, the public is aware that budget priorities change at the federal level, and that such changes could affect management of a disposal facility. Establishing a fund for perpetual maintenance and monitoring at the onset can assuage public concerns regarding the availability of federal resources to maintain and repair the facility over the long-term provided that such a fund is permissible under federal policies.

The recent events at Hanford's ERDF also demonstrate that an independent technical team can be particularly helpful in assuring the public and regulatory agencies that the design, construction, operation, and maintenance of an on-site disposal facility is being done in a proper manner (Benson et al. 2007). A similar team would be effective when developing the OSWDF, provided the team is chartered as being truly independent of DOE.

6. LINE OF INQUIRY NO. 4

What are the lessons learned from proposed on-site disposal facilities that were not approved by the public and the regulators?

The ITR team is not aware of any on-site disposal facilities within the DOE complex that were not approved. However, the ITR team members have experience with other applications for waste containment facilities that were not approved. These experiences have indicated that three issues need particular attention.

First, stakeholders need to be involved in the siting, development, and design process from the beginning. Stakeholders also need to be confident that they are partners in the decision making. Applications fail when stakeholders are brought into the process after many of the decisions have been made that preclude changes that may be important to the stakeholders.

Second, stakeholders and owners often have different priorities. Realizing that both sets of priorities deserve comparable attention is important. Applications fail when stakeholders believe that their priorities are judged to be of lesser importance than those of the owner. Management

overseeing projects such as the OSWDF need to be able to put itself in the position of the stakeholders so that stakeholder priorities receive adequate attention.

Third, the entire process needs to be transparent. Hidden details (intentional or unintentional) will be uncovered in any major environmental project, and they can seriously impact or prevent an application from being approved. The project team must be diligent in preparing documentation describing all elements that are potentially controversial. This documentation needs to be readily accessible and presented in a clear and frank manner.

7. LINE OF INQUIRY NO. 5

What are the resources that would be useful to inform the public on the concept of an on-site disposal facility?

A collection of well-integrated documents that discuss the big picture of the project and each of the technical issues should be developed (see LOI No. 2). Stakeholders need to be able to understand the conceptual framework and how decisions are made along the way. Step-wise documentation is important, as some stakeholders will become involved part way through the process.

DOE should also document the history of its on-site disposal facilities and compare the risks imposed by these facilities to other disposal and management options. This report should be available on a website and should be prepared by an independent group so that the validity of the conclusions cannot be viewed as biased in favor of DOE.

8. LINE OF INQUIRY NO. 6

The Department has proposed to develop an on-site disposal facility under CERCLA. Some of the regulators from the State of Ohio have recommended a RCRA permit approach. What are the lessons learned that would apply to the evaluation of these two concepts for the Portsmouth D&D Project?

There are advantages of developing a facility under both CERCLA and RCRA. DOE will need to study the relative advantages and disadvantages of both mechanisms, and select the mechanism that will have the greatest positive benefit to the project over the long term.

CERCLA was created to deal with inactive hazardous waste sites. CERCLA was designed primarily to respond to situations involving past disposal of hazardous substances, but includes provisions to address new releases. To a large degree, however, CERCLA was intended to address past disposal sites and to complement RCRA, which was designed to provide “cradle-to-grave” management of hazardous waste.

A state can be authorized to implement a RCRA corrective action program. In these cases, the authorized state program operates in lieu of the federal RCRA corrective action requirements. In

contrast, CERCLA has no provision for delegating response authority to the states. However, in many cases, CERCLA activities have been managed by states with oversight by US EPA.

Because of statutory exemptions, CERCLA response actions done entirely on-site do not required RCRA permits and are not subject to other administrative requirements of other laws. Thus, the OSWDF would not require a RCRA landfill permit if remedial actions at PORTS are under CERCLA. In contrast, permit exemptions are not inherent in RCRA corrective actions.

The selection of CERCLA vs. RCRA may affect waste acceptance criteria and administration of the project. Lessons learned from other DOE sites should be reviewed when weighing the merits of CERCLA and RCRA for the actions at PORTS. However, the regulatory approach will not affect environmental protection, the health and safety of the public, or the environmental performance of the proposed OSWDF. Other on-site disposal facilities reviewed by the ITR team at the Hanford Reservation, Idaho National Laboratory, and the Oak Ridge Reservation, which were developed under CERCLA, are performing as anticipated and are protective of the environment.

9. RECOMMENDATIONS

The following recommendations are made by the ITR team regarding the proposed OSWDF:

- Public involvement will be critical to acceptance of the proposed OSWDF. Ensuring that stakeholder groups are given ample opportunity to ask questions and be heard on their issues will be important. DOE will need to use care to ensure that some groups are not perceived as receiving favorable or greater attention by DOE relative to other groups. Coordinating stakeholder discussion and responses will also be a challenge. An independently chartered umbrella organization could be created to facilitate interactions between all interested parties and DOE. Mechanisms should also be provided for stakeholders not affiliated with a group to voice their concerns and receive responses from DOE.

- Documentation should be provided to stakeholders in both electronic (web site) and paper format that has information at multiple levels. An inclusive summary prepared in layman's terms should be the starting point. A second level would have a moderate amount of technical discussion coupled with a collection of references to other documents with more detailed information. A third level would provide technical details substantiating the assumptions and design details of the OSWDF. At all levels, the documentation should include supporting information from the institutional history being complied at other on-site disposal facilities being operated in the DOE complex. Performance information from other hazardous and non-hazardous waste disposal facilities employing similar containment technologies should also be included.

- The strong operating record of on-site disposal facilities in the DOE complex should be considered in the decision-making process. Modern facilities constructed and operated by DOE have been demonstrated as a safe and reliable means of disposing hazardous waste,

low-level radioactive waste, and mixed low-level radioactive waste. DOE-EM should create a website and report documenting the history of its modern on-site disposal facilities and compare the risks imposed by these facilities to other disposal and management options.

- The public is aware that budget priorities change at the federal level, and that these changes can affect long-term operation and management of a federal disposal facility. Establishing a fund for perpetual maintenance and monitoring at the onset (if permissible under federal policy) can assuage public concerns regarding the availability of federal resources over the long-term.

- The recent events at Hanford's ERDF demonstrate that an independent technical team can be particularly helpful in ensuring stakeholders that design, construction, operation, and maintenance of an on-site disposal facility are being done in a proper manner. A similar team review or assistance could be beneficial for the proposed OSWDF.

- Stakeholders and DOE need to be partners in the siting, development, and design process from the beginning. Realizing that stakeholder and DOE priorities deserve comparable attention is also important.

- There are advantages of developing a facility under either CERCLA or RCRA. DOE will need to study the relative advantages and disadvantages of both mechanisms, and select the mechanism that will have the greatest benefit to the project over the long term. Environmental performance of an on-site disposal facility will not be affected by the regulatory approach that is followed. Either regulatory approach will yield a solution that protects the environment and the health and safety of the public.

10. ACKNOWLEDGEMENT

This technical review was supported by Mark Gilbertson (DOE-HQ), Dinesh Gupta (DOE-HQ), and Jud Lilly (DOE-PORTS). Vincent Adams (DOE-HQ) and Owen Robertson (DOE-RL) participated in the site visit and the review. The ITR thanks those individuals with DOE who provided information and input during the review.

11. REFERENCES

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Bonaparte, R., Daniel, D., and Koerner, R. (2002), Assessment and Recommendations for Improving the Performance of Waste Containment Systems, Report No. EPA/600/R-02/099, Office of Research and Development, US Environmental Protection Agency, Cincinnati, OH.

DOE (2006), Portsmouth Gaseous Diffusion Plant Decontamination and Decommissioning Project, On-Site Waste Disposal Facility Conceptual Design – Final Submittal, US Department of Energy, Portsmouth Operations, August 2006.

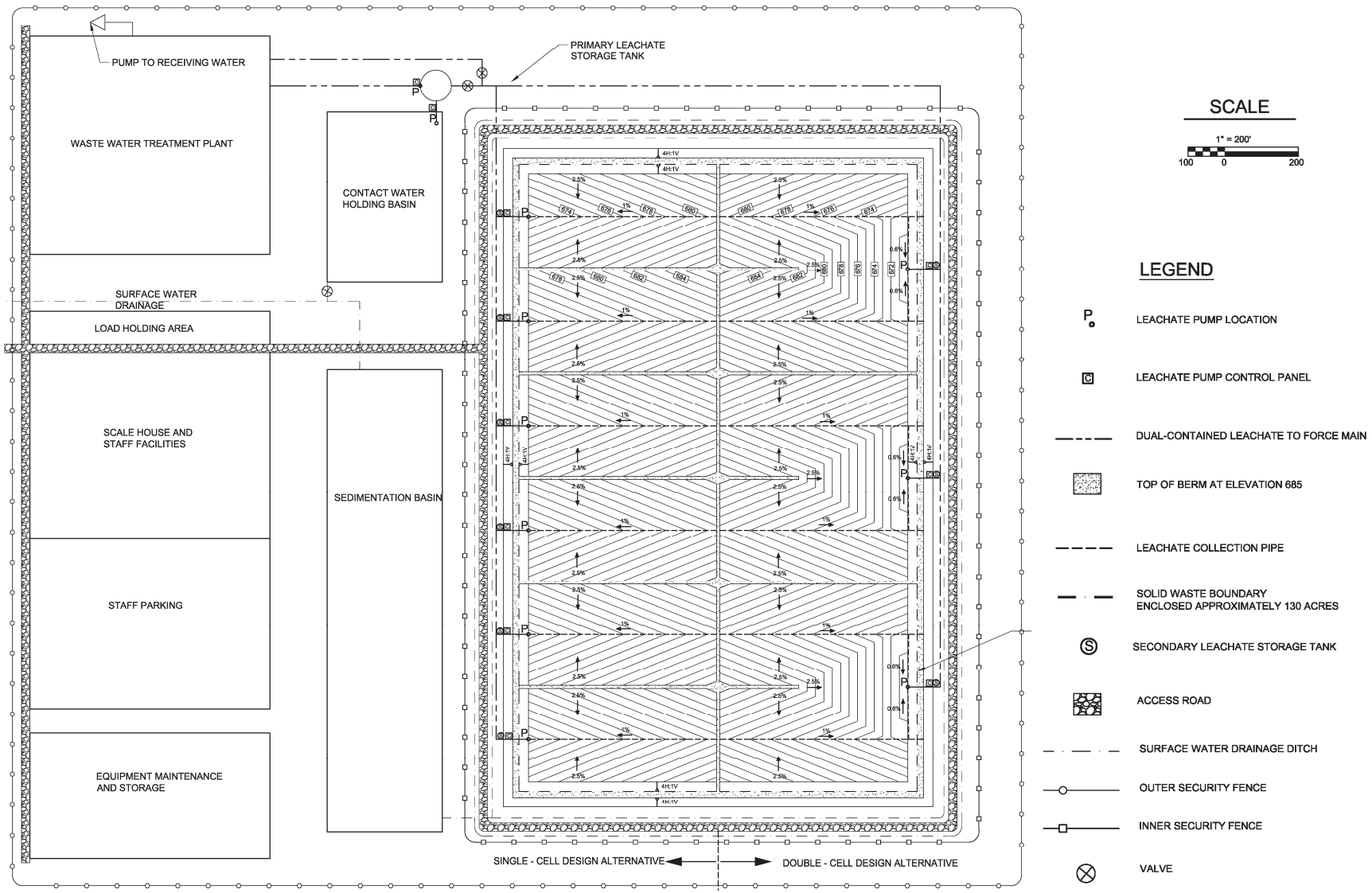
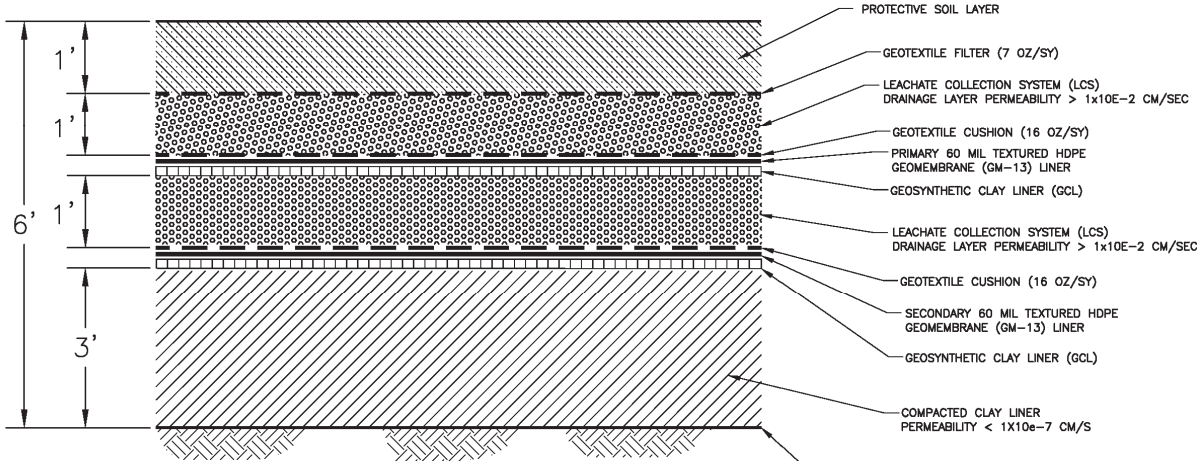
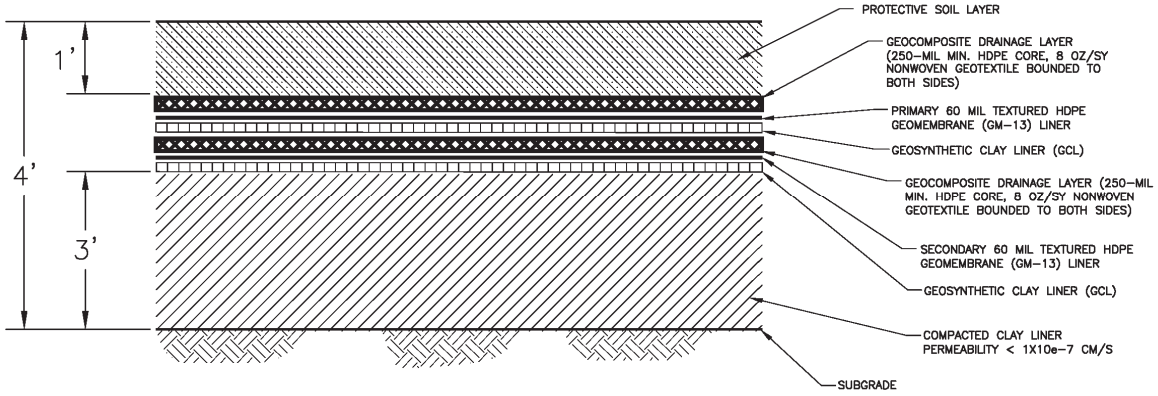


Fig. 1. Plan view schematic of cells and associated facilities for the proposed OSWDF. Surface shown has top-of-liner grades.



(a) base detail



(b) side slope detail

Fig. 2. Schematic of double liner system proposed for the OSWDF: (a) base detail and (b) side slope detail.

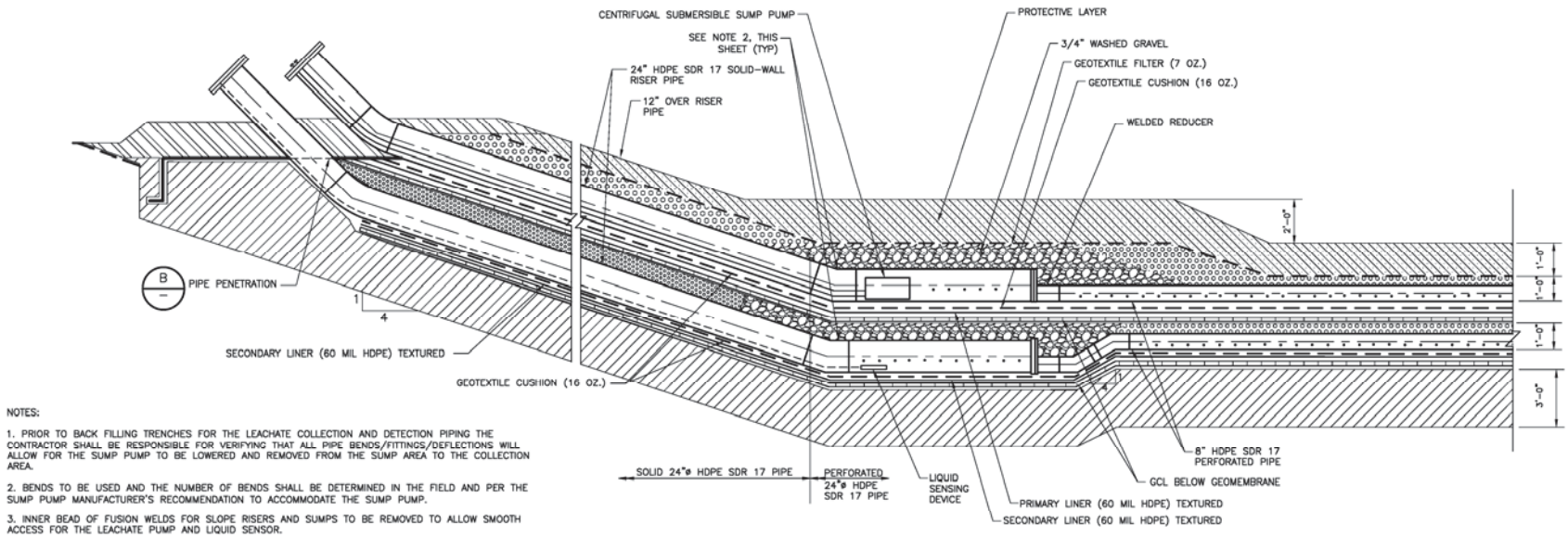


Fig. 3. Proposed side slope risers used to remove leachate from the leachate collection system and liquid from the leak detection zone at the OSWDF.

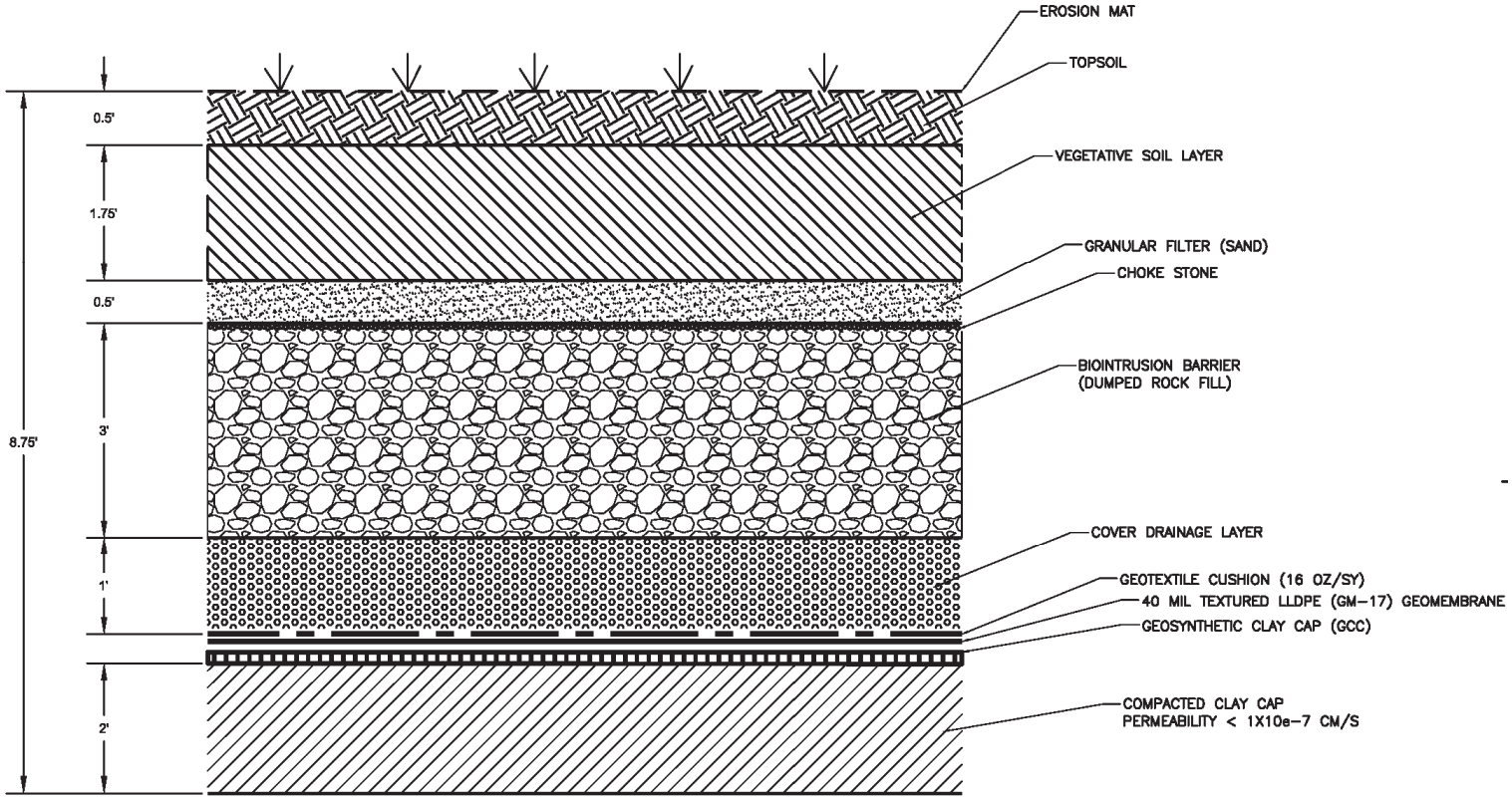


Fig. 4. Schematic of cover profile proposed for the OSWDF.

APPENDIX

ITR COMMENTS ON THE PRELIMINARY DESIGN OF THE OSWDF

Introduction: The On-Site Waste Disposal Facility (OSWDF) is proposed for long-term containment of contaminated materials from the planned Decontamination and Decommissioning (D&D) activities at the PORTS facility. Acceptable performance of the proposed OSWDF will depend on interactions between engineered landfill features and operations methods that recognize the unique characteristics of the waste stream and site-specific environmental conditions. Major issues of interest regarding the proposed landfill are (1) siting, (2) design of the liner, (3) design of the final cover, (4) waste placement methods and logistics, (5) waste transportation, characterization and tracking, and (6) automation. These features are described conceptually in "Portsmouth Gaseous Diffusion Plant Decontamination and Decommissioning Project On-Site Waste Disposal Facility Conceptual Design – Final Submittal" (DOE 2006). Some of the issues noted here are common to other DOE facilities visited by the ITR team. Thus, this is an opportunity to share lessons learned.

Siting: There are four locations under consideration for the proposed landfill at PORTS. Preliminary inspection suggests that all four locations are suitable from a hydrogeological perspective, as they are underlain by natural fine-grained sediments. However, ground water is contaminated beneath some of these locations. Selecting a location where ground water is not contaminated may be beneficial, as discriminating between sources of contaminants could become an issue in the future.

There are lessons in logistics to be considered from other DOE sites that the ITR team has visited that may affect siting. The primary lesson is related to the required soil-to-debris ratio and the logistics of delivering waste materials to the landfill at the appropriate times. Use of imported soil for burial operations should be minimized to the extent practical to optimize use of landfill capacity. Some of the proposed landfill locations are currently occupied by buildings or other facilities, which may complicate logistics associated with the timing of waste streams (namely debris and contaminated soils), construction of cells in the OSWDF, and the availability of lined areas to stockpile wastes by type so that disposal operations can be as efficient as possible. The ITR team recommends that the landfill construction and operation plans be carefully reviewed and coordinated with the D&D plans so that the OSWDF is filled with contaminated material (as opposed to clean fill) to the greatest extent possible.

Liner: The conceptual double-composite liner reflects the importance of this feature to waste containment. The combination of geomembrane and low-conductivity soil layers has been shown to work well and is appropriate for the site. The conceptual plan also recognizes that the thickness of the soil layer over the liner may be variable to meet the needs of different types of waste. The ITR team regards this as an important feature.

Chemical compatibility testing of all liner elements will need to be conducted to ensure that adverse effects will not be incurred when these elements are exposed to OSWDF leachate. This

testing needs to be conducted in the context of the 1000-yr design life anticipated for DOE's on-site disposal facilities. The ITR team also recommends careful review of recent research and development related to composite liners to further refine the conceptual design for the liner.

The conceptual design document did not discuss how radionuclide transport through the liner in the OSWDF was analyzed. Previous reviews conducted by the ITR team have determined that assumptions made regarding radionuclide transport have been overly conservative, and have not adequately accounted for the attenuation capacity of the barrier system. A more detailed analysis of radionuclide transport may prove beneficial during OSWDF design.

The ITR team has reviewed the proposed base grades for the OSWDF and recommends that the sumps be moved to one side of the facility if possible, rather than being centrally located. This will minimize the distance over which pumps must be deployed and will reduce the overburden stress on the risers.

Final cover: The conceptual final cover proposed for the OSWDF landfill is a multi-layered design with features intended to provide hydraulic control at the upper surface of the waste and to resist erosion. Current landfill cover design recognizes two distinct mechanisms to control percolation into waste: (1) low-conductivity layers designed to resist the downward movement of water and (2) a combination of enhanced storage of precipitation in the upper portion of the cover and removal of that water by evapotranspiration. The conceptual design at OSWDF includes both types of design elements and is appropriate to the high precipitation climate of the southern Ohio location and the rigorous performance requirements for the facility. Recent studies have demonstrated that even composite barriers allow some drainage. Thus, carefully designing the store-and-release component to maximize control of the water balance in the upper portions of the cover may be critical to the performance of the facility.

Two issues that should receive careful consideration to refine the conceptual design of the final cover. These issues are common to other DOE facilities:

- Settlement of the waste may affect the performance of the lower resistive layers in the cover. Preferential flow may occur if cracks develop in those layers (both geomembrane and soil barriers) as a result of differential settlement of the underlying waste. The ITR team strongly believes that there must be a close tie between final cover design and specification of methods for placement of the waste. Stability of the waste is critical to acceptable long-term performance of the final cover over the 1000-yr design life anticipated for DOE facilities. More discussion on this issue is included in the following section on waste placement.

- Recent studies have shown that performance of resistive layers can be improved by limiting the amount of water that reaches those layers. Accounting for the store-and-release characteristics of the upper portion of the cover may be important when evaluating the

performance of the cover for the proposed OSWDF. The ITR team recommends review and refinement of the conceptual design of the store-and-release components of the final cover.

Waste Placement Methods: Long-term stability of the resistive barrier layers has implications for both cover design and landfill operations. The waste stream at PORTS will include large quantities of material with a very high percentage of void space. While this is a concern in all landfill operations and at other DOE facilities, disposal of the converters at PORTS creates considerable challenges. Most landfilling operations make efforts to minimize void space by crushing and compacting waste. The ITR team recognizes that such activities pose unusual problems for the converters scheduled for disposal at OSWDF. Current planning documents recognize the need to restrict settlement over broad distances in order to maintain surface drainage, but do not address the implications of localized settlement within the waste that may be imposed by disintegration of the convertors, particularly over the 1000-yr design life anticipated for the OSWDF. Low-conductivity soil layers and geomembranes can be damaged by differential settlement and such damage may compromise cover performance. Additionally, the relatively thick overlying layers will make locating and repairing damage to the barrier layers difficult and expensive.

The current conceptual design document describes several general methods in support of the concluding statement "Use of the above measures should reasonably allow for direct placement of the large GDP converters into the OSWDF without the need for their segmentation or filling of the interior void spaces." The ITR team notes that waste placement methods and the requirements of the final cover have become very important to the other DOE facilities already visited. This issue will likely be important to the OSWDF, and will require a thorough examination.

Reviews conducted at other sites have shown that settlement of the waste is a key issue that may affect long-term performance. Greater understanding of the long-term settlement characteristics of waste masses comprised of soil and debris is needed. DOE should examine this issue in greater detail during the conceptual design stage. Field testing of compaction methods to evaluate their impact on settlement should be considered. Innovative compaction technologies (e.g., "intelligent" compaction methods) should also be explored, as has been done at other DOE disposal facilities.

Waste Transportation, Tracking, and Characterization: Characterizing and tracking of wastes will be important to ensure that the wastes placed in the OSWDF are acceptable. The use of electronic tracking methods should be explored when designing entry control facilities for the OSWDF. Experience with electronic tracking methods at Oak Ridge may be beneficial.

DOE should consider using dedicated haul roads for transporting wastes to the on-site disposal facility. Use of public roadways for transporting waste to a disposal facility can affect the efficiency of the disposal facility as well as the disposition and characteristics of the waste mass. For example, at the Idaho National Laboratory, waste is transported to the disposal facility in sealed containers because transportation occurs over public roadways. All of these containers must be grouted when placed in the disposal facility, which is an inefficient use of landfill capacity and a more costly disposal methodology. The presence of these grouted masses has also led to questions regarding differential settlement of the final cover.

Automation: Methods to automate operation and monitoring of the OSDF should be explored to the greatest extent practical. For example, the ITR has recommended automated methods to monitor waste compaction, barrier and collection systems, and waste tracking. Automated methods eliminate human error, and build public confidence provided automated systems are tested periodically. Automated methods can also ensure more complete and accessible records for auditing, and can be programmed to provide alerts should a failure or unusual change in performance occur. Cost savings can also be accrued through automation.

Summary: The ITR team regards the following issues as important to the long-term performance of the OSWDF:

- Research and development on composite liners should be reviewed so that the liner design can be optimized.

- Chemical compatibility testing should be conducted on all liner components as part of the OSWDF design process.

- The assumptions made regarding radionuclide transport in the liner should be examined to ensure that the attenuation capacity of the barrier systems has been accounted for adequately.

- Relocation of sumps along the perimeter of the OSWDF should be considered.

- Large void spaces may form over time as the convertors disintegrate. The impact of these void spaces on performance of the cover needs a thorough evaluation in the context of the 1000-yr design life anticipated for the OSWDF.

- Differential settlement should be minimized to prevent damage to the resistive barrier layers in the final cover. Waste placement methods must be developed that will ensure that differential settlements over the 1000-yr design life are tolerable.

- The store-and-release components of the cover design should be optimized.

- Waste placement methods must explicitly account for the linkage between waste settlement, cover performance, and the long-term performance requirements of the facility.

- PORTS management should consider a small-scale field experiment to further develop waste placement methods. Such an experiment is in progress at Hanford's ERDF and was conducted at Oak Ridge's EMWMF. The ITR team recommended that a similar experiment be conducted at Idaho's ICDF. Such an experiment might consider methods for placement in the landfill of the items with large void spaces. Results of such a test can be an excellent tool to support technical decision-making and communication with the public. Innovative compaction technologies (e.g., "intelligent compaction") should also be explored.

- A dedicated haul road should be considered to eliminate the need to transport wastes over public roadways.

- Automation should be used to the greatest extent practical for operating and monitoring the OSWDF.